Georgia Department of Public Health Healthcare-Associated Infections Report

January 1, 2014 – December 31, 2014

March 2016

Contents

List of Tables

List of Figures

Executive Summary

Healthcare-associated infections (HAI) are a serious public health threat, affecting 1 in 25 hospital inpatients[1] and causing up to $45 billion annually in direct hospital costs[2]. In 2013, the HAI reportable to the Centers for Medicaid and Medicare Services' (CMS) Quality Reporting Program were made reportable to the Georgia Department of Public Health (DPH) via the Centers for Disease Control and Prevention's (CDC's) National Healthcare Safety Network (NHSN)—a secure, web-based HAI tracking system. This report provides aggregate Georgia HAI data to establish 2013 baselines, to compare state performance to national and state goals, and to measure progress between 2013 and 2014. This report provides data from 125 Georgia facilities on the following HAI:

1. Central line-associated bloodstream infections (CLABSI)
2. Catheter-associated urinary tract infections (CAUTI)
3. Surgical site infections (SSI) following colon surgery (COLO)
4. Surgical site infections following abdominal hysterectomy (HYST)
5. Laboratory-identified (LabID) methicillin-resistant *Staphylococcus aureus* (MRSA) found in the bloodstream
6. Laboratory-identified *Clostridium difficile* (*C. difficile*) found in stool

Performance is assessed using the standardized infection ratio (SIR). This metric is calculated by dividing the number of infections observed by the number of infections predicted. Lower SIR (< 1.0) indicate better performance.

Key Findings:

Improved Areas

- In adult and pediatric intensive care units (ICU) in Georgia, the CLABSI SIR decreased 21% between 2013 and 2014—a decrease of 94 infections. The Health and Human Services (HHS) reduction goal of 0.50 is well within reach, requiring the prevention of 12 infections per year.

[1] Magill SS, Edwards JR, Bamberg W, et al. Multistate Point-Prevalence Survey of Health Care–Associated Infections. *N Engl J Med* 2014;370:1198-208. Accessed January 14, 2016.
[2] Scott RD II. The Direct Medical Costs of Healthcare-Associated Infections in U.S. Hospitals and the Benefits of Prevention. 2009. Retrieved from: http://www.cdc.gov/HAI/pdfs/hai/Scott_CostPaper.pdf. Accessed January 14, 2016.

Top Concerns—focused infection control interventions are needed

- Georgia facilities reported 30% more CAUTI than predicted—an excess of 259 infections. To reach the HHS reduction goal of 0.75, 476 infections per year must be prevented.
- The *C. difficile* SIR increased 12% between 2013 and 2014—an increase of 240 infections. To reach the HHS reduction goal of 0.70, 661 infections per year must be prevented.

Improvement Possible—focused infection control interventions may be needed

- There were about as many CLABSI in long-term acute care hospitals as predicted, and 33 infections per year must be prevented to reach the HHS reduction goal of 0.50. The SIR in long-term acute care hospitals is higher than the SIR in other facility types, which may represent the need for improved infection control efforts in these hospitals.
- In Georgia, there was no significant change in SIR between 2013 and 2014 for CLABSI in neonatal ICU (NICU), COLO SSI, HYST SSI, or MRSA. Infection control interventions may be needed to reduce these HAI.
    - There were fewer CLABSI than predicted in NICU, but 19 infections per year must be prevented to reach the HHS reduction goal of 0.50.
    - There were fewer COLO SSI than predicted and as many HYST SSI as predicted. To reach the HHS reduction goal of 0.75, 21 COLO SSI and 17 HYST SSI must be prevented per year.
    - There were as many MRSA infections as predicted and 93 infections per year must be prevented to reach the HHS reduction goal of 0.75.

Introduction

This report provides aggregate Georgia healthcare-associated infections (HAI) data to establish 2013 baselines, to compare state performance to national and state goals, and to measure progress between 2013 and 2014.

Background

HAI are infections that develop during or soon after medical treatment for a separate medical condition. HAI can result from patients' own bacteria, be associated with surgery or invasive medical devices, or be due to exposure to bacteria, viruses, fungi, or spores transmitted from contaminated healthcare workers' hands, environmental surfaces, or medical equipment. Bacteria found in healthcare settings are often resistant to commonly prescribed antibiotics, making HAI more difficult to treat.

A 2011 survey of 183 acute care hospitals across the US found that on any given day, 1 in 25 inpatients had at least one HAI[3]. The direct cost of treating HAI ranges from $28.4 to $45 billion per year for US healthcare facilities. Preventing 20% of HAI could save up to $6.8 billion, and preventing 70% of HAI could save up to $31.5 billion per year[4].

In January 2013, the HAI reportable to the Centers for Medicaid and Medicare Services' (CMS) Quality Reporting Program were added to the Georgia Department of Public Health (DPH) Notifiable Disease List. Facilities self-report data to DPH using the Centers for Disease Control and Prevention's (CDC's) National Healthcare Safety Network (NHSN), a secure, web-based HAI tracking system. Under Georgia law (O.C.G.A Sections 32-2-12 and 31-5-5), data submitted to DPH through NHSN remain confidential.

Four types of facilities in Georgia are included in this report: acute care hospitals, critical access hospitals, children's hospitals, and long-term acute care hospitals. Because long-term acute care hospitals have different CMS reporting requirements and different baseline comparison periods, they will be analyzed separately from the other facility types. Acute care, critical access, and children's hospitals will be referred to collectively as "hospitals."

[3] Magill SS, Edwards JR, Bamberg W, et al. Multistate Point-Prevalence Survey of Health Care–Associated Infections. *N Engl J Med* 2014;370:1198-208

[4] Scott RD II. The Direct Medical Costs of Healthcare-Associated Infections in U.S. Hospitals and the Benefits of Prevention. 2009. Retrieved from: http://www.cdc.gov/HAI/pdfs/hai/Scott_CostPaper.pdf

The select HAI included in this report are:

1. Central line-associated bloodstream infections (CLABSI)
2. Catheter-associated urinary tract infections (CAUTI)
3. Surgical site infections (SSI) following colon surgeries (COLO)
4. Surgical site infections following abdominal hysterectomies (HYST)
5. Laboratory-identified (LabID) methicillin-resistant *Staphylococcus aureus* (MRSA) found in the bloodstream
6. Laboratory-identified *Clostridium difficile* (*C. difficile*) in stool

This report includes data from 15 long-term acute care hospitals and 110 hospitals in Georgia—including 103 acute care hospitals, 5 voluntarily reporting critical access hospitals, and 2 voluntarily reporting children's hospitals. These 125 facilities reported up to six HAI, depending on (1) CMS reporting requirements and (2) applicability of the HAI measure (e.g., a facility that does not perform colon surgeries cannot report infections following colon surgeries). Table 1 provides the number and type of reporting facilities.

Table 1: Number and Type of Facilities Reporting HAI Data—Georgia, 2014

HAI Type	No. Acute Care Hospitals Reporting	No. Long-Term Acute Care Hospitals Reporting	No. Critical Access Hospitals Reporting	No. Children's Hospitals Reporting
CLABSI	91	15	2	2
CAUTI	91	15	2	2
COLO	94	No Reporting Required	2	0
HYST	94	No Reporting Required	2	0
C. difficile	103	No Reporting Required	4	0
MRSA	103	No Reporting Required	3	0

A full list of acronyms used in this report can be found in Appendix I, and Appendix II lists references for NHSN protocols.

Methods

Infection data analyzed in this report were downloaded from NHSN on December 16, 2015. Facilities that were in operation during the full 2014 calendar year and met the CMS reporting requirements for at least one HAI were included in the analysis.

Hospitals' HAI data were compared to national baseline data using the standardized infection ratio (SIR) and to the 2013 Health and Human Services (HHS) National Action Plan HAI reduction goals using the number of infections needed to prevent (NNTP) metric. In long-term acute care hospitals, the SIR is used to compare HAI data to 2013 NHSN data, as national baseline data is currently unavailable.

The SIR shows if the state has more, fewer, or about the same number of HAI compared to the number predicted based on the applicable baseline data.

$$\text{SIR} = \frac{\text{Number of Observed Infections}}{\text{Number of Predicted Infections}}$$

The SIR is a summary measure that can be used to track HAI over time and can be calculated on a variety of levels, including unit, facility, state, and nation. It adjusts for differences between healthcare facilities such as types of patients and procedures, as well as other factors such as the facility's size, and compares the number of infections reported in a given time period to the number of infections that would be predicted using data from a baseline time period, which varies for different infection types (see Appendix III). Lower SIR (< 1.0) indicate better performance.

When the SIR is calculated, there are three possible results:

- The SIR is **less than 1.0**—this indicates that there were fewer infections reported during the surveillance period than would have been predicted given the baseline data.
- The SIR is **equal to 1.0**—this indicates that the number of infections reported during the surveillance period is the same as the number of infections predicted given the baseline data.
- The SIR is **greater than 1.0**—this indicates that there were more infections reported during the surveillance period than would have been predicted given the baseline data.

SIR and SIR confidence intervals by quarter for each HAI during 2013 and 2014 in Georgia are presented later in the report.

The NNTP shows the number of infections that the state as a whole must prevent in one year to reach the 2013 HHS HAI national reduction goals (Table 2). The NNTP is also referred to as the cumulative attributable difference (CAD) by CDC.

NNTP = Number of Observed Infections - (HHS Reduction Goal*Number of Predicted Infections)

The NNTP is part of the CDC's Targeted Assessment for Prevention (TAP) strategy, which seeks to identify areas in need of targeted HAI prevention activities and quality improvement. Lower NNTP indicate better performance.

When the NNTP is calculated, there are three possible results:

- The NNTP is **less than 0**—this indicates that the SIR was lower (better) than the HHS reduction goal and shows how far from the goal the SIR was.
- The NNTP is **equal to 0**—this indicates that the SIR was the same as the HHS reduction goal.
- The NNTP is **greater than 0**—this indicates that the SIR was higher (worse) than the HHS reduction goal and shows how far from the goal the SIR was.

Table 2: 2013 HHS HAI National Reduction Goals

2013 HAI Reduction Goal	Applicable HAI Types
Reduce by 50%, SIR goal = 0.50	CLABSI
Reduce by 30%, SIR goal = 0.70	*C. difficile*
Reduce by 25%, SIR goal = 0.75	CAUTI, COLO, HYST, MRSA

When HAI are reported, up to three pathogens can be entered as causative agents of that HAI event. Duplicated pathogens were deleted if they differed by susceptibility pattern or were also entered as the causative agent of a secondary bloodstream infection.

The distribution of pathogens identified from HAI is discussed later in the report (see pages 13, 16, 18, 20). Antimicrobial susceptibility data were available for select species and phenotypes:

1. Methicillin-resistant *Staphylococcus aureus*
2. Carbapenem-resistant Enterobacteriaceae
3. Carbapenem-resistant *Escherichia coli*
4. Carbapenem-resistant *Enterobacter* spp.
5. Carbapenem-resistant *Klebsiella pneumonia* and *K. oxytoca*
6. Carbapenem-non-susceptible *Pseudomonas aeruginosa*
7. Carbapenem-non-susceptible *Acinetobacter* spp.
8. Multidrug-resistant *P. aeruginosa*
9. Multidrug-resistant *Acinetobacter* spp.
10. Vancomycin-resistant *Enterococcus faecalis*
11. Vancomycin-resistant *Enterococcus faecium*

Where the same pathogen species was entered twice with different susceptibility patterns, the phenotypes were carbapenem-non-susceptible (carbNS) and multidrug-resistant (MDR). Given that MDR includes carbNS and is the more inclusive phenotype, the MDR was retained and the other deleted (e.g., MDR and carbNS *P. aeruginosa* are listed for the same event so the carbNS *P. aeruginosa* is deleted).

When CAUTI and SSI are reported, one of the pathogens entered as a causative agent can be entered again as the causative agent of a secondary bloodstream infection. In these instances, the duplicated pathogen was deleted (e.g., *E.coli* was listed twice for a COLO SSI where a secondary BSI occurred so the second instance of *E. coli* was deleted).

Results

Facility Characteristics

Of the 125 Georgia facilities, 124 completed the 2014 NHSN Annual Hospital Survey or the 2014 NHSN Annual Facility Survey for Long-Term Acute Care Hospitals. The surveys provided medical affiliation and bed size, which are two factors that may impact the number of infections reported by a facility. These factors are included in the SIR risk adjustment performed by the CDC for CLABSI, CAUTI, and LabID infections (see Appendix III).

The majority of facilities (99, 80%) have no affiliation with a medical school. About a quarter of facilities (33, 27%) report having fewer than 50 beds; 53 (43%) report having between 50 to 199 beds; and 38 (31%) report having at least 200 beds (Table 3).

Table 3: Medical Affiliation and Bed Size of Facilities with a 2014 NHSN Annual Survey—Georgia, 2014

Medical School Affiliation	≤ 25 Beds	26 to 49 Beds	50 to 199 Beds	200 to 499 Beds	≥ 500 Beds	Total
No Affiliation	10	21	49	15	4	99
Graduate	0	1	2	2	5	10
Major Teaching	0	0	1	3	5	9
Undergraduate	1	0	1	4	0	6
Total	11	22	53	24	14	124

Type of patient care location is another risk factor that can affect number of CLABSI and CAUTI reported by facilities, due to the differences in patient acuity. In 2014, only intensive care units (ICU) and long-term acute care locations were required to report CLABSI and CAUTI. Medical/surgical critical care locations reported most often (89, 40%), followed by medical critical care locations (21, 9.3%), and level II/III neonatal critical care locations (21, 9.3%) (Table 4).

Table 4: Number and Type of Facility Locations Required to Report HAI Data—Georgia, 2014

Reporting Locations	N	%
Medical/Surgical Critical Care	89	39.6
Medical Critical Care	21	9.3
Neonatal Critical Care (Level II/III)	21	9.3
LTAC Ward	20	8.9
Medical Cardiac Critical Care	16	7.1
Surgical Cardiothoracic Critical Care	15	6.7
Neonatal Critical Care (Level III)	13	5.8
Neurosurgical Critical Care	7	3.1
Pediatric Medical/Surgical Critical Care	5	2.2
Surgical Critical Care	5	2.2
Neurologic Critical Care	4	1.8
Trauma Critical Care	4	1.8
Burn Critical Care	2	0.9
LTAC ICU	2	0.9
Pediatric Cardiothoracic Critical Care	1	0.4
Total	225	100

Overall State Performance

In 2014, Georgia hospitals reported 4,708 HAI. There were 94 fewer ICU CLABSI with a statistically significant 21% decrease in SIR between 2013 and 2014. There were 11 fewer CLABSI in neonatal ICU (NICU), 89 fewer CAUTI, 27 fewer COLO SSI, 14 fewer HYST SSI, and 9 fewer MRSA infections, none of which resulted in statistically significant change in SIR between 2013 and 2014. An additional 240 *C. difficile* infections were reported, with a statistically significant 12% increase in SIR between 2013 and 2014.

Georgia hospitals have not reached the HHS reduction goal for any HAI, but progress has been made. Hospitals are close to reaching the HHS reduction goals for CLABSI and SSI. To reach the CLABSI goal of 0.50, a total of 12 ICU CLABSI and 19 NICU CLABSI in all Georgia facilities must be prevented per year. To reach the SSI goal of 0.75, 21 COLO SSI and 17 HYST SSI must be prevented per year. Reaching the HHS reduction goal of 0.75 for LabID infections and CAUTI will be more challenging, requiring a reduction of 93 MRSA infections, 661 *C. difficile* infections, and 383 CAUTI per year in Georgia hospitals (Table 5).

Table 5: Overall Infection and SIR Data for Hospitals—Georgia, 2014

	ICU CLABSI	NICU CLABSI	CAUTI	COLO	HYST	MRSA	*C. difficile*
2013 State Data							
State SIR 2013	0.66*	0.70*	1.37*	0.89	1.00	1.05	0.82*
Observed Infections 2013	396	90	989	261	113	333	2,530
Predicted Infections 2013	602	129	720	292	113	317	3,082
Facility Count 2013	96	31	96	98	97	108	108
Denominator Counts	**Device Days**			**Procedures**		**Patient Days**	
	303,212	51,709	366,402	8,917	11,692	4,579,602	4,167,557
2014 State Data							
State SIR 2014	0.52*	0.66*	1.30*	0.82*	0.90	1.05	0.92*
Observed Infections 2014	302	79	900	234	99	324	2,770
Predicted Infections 2014	580	120	690	284	110	309	3,013
Facility Count 2014	95	31	95	96	96	106	107
Denominator Counts	**Device Days**			**Procedures**		**Patient Days**	
	293,233	48,673	351,057	8,715	11,425	4,594,458	4,180,790
2013—2014 State Comparison							
Infection Count Difference	-94	-11	-89	-27	-14	-9	240
SIR Difference	-21%*	-6%	-5%	-8%	-10%	0%	12%*
HHS—2014 SIR Comparison							
HHS Reduction Goal	0.50	0.50	1.06	0.92	0.86	0.92	0.90
NNTP to Reach HHS Goal	12	19	383	21	17	93	661

**Denotes statistical significance at p = 0.05*

In 2014, long-term acute care hospitals reported 303 infections. There were about as many CLABSI as predicted and 28% more CAUTI than predicted. Reaching the HHS reduction goal in long-term acute care hospitals will require the prevention of 33 CLABSI and 93 CAUTI per year (Table 6).

Table 6: Overall Infection and SIR Data for Long-Term Acute Care Hospitals—Georgia, 2014

	CLABSI	CAUTI
State SIR	0.85	1.28*
Observed Infections	80	223
Predicted Infections	94	174
Facility Count	15	15
Device Days	102,707	86,095
HHS—2014 SIR Comparison		
HHS Reduction Goal	0.50	0.75
NNTP to Reach HHS Goal	33	93

**Denotes statistical significance at p = 0.05*

Central Line-Associated Bloodstream Infections

In 2014, a total of 461 CLABSI were reported from 95 hospitals and 15 long-term acute care hospitals. Of these 461 infections, 302 (66%) occurred in hospital adult and pediatric (AP) ICU; 79 (17%) occurred in hospital NICU; and 80 (17%) occurred in long-term acute care hospital locations.

Since CLABSI SIR is significantly higher in NICU than in adult and pediatric ICU, these two location types were analyzed separately (Table 7). Of the 95 hospitals, 54 (57%) reported at least one CLABSI in AP ICU. None reported having significantly more infections and 17 (18%) reported having significantly fewer infections than predicted. Of the 33 NICU locations, 19 (58%) reported at least one CLABSI. None reported having significantly more infections and 3 (9%) reported having significantly fewer infections than predicted. Of the 15 long-term acute care hospitals, 14 (93%) reported at least one CLABSI. Two (13%) reported having significantly more infections and 4 (27%) reported having significantly fewer infections than predicted.

Table 7: Selected Characteristics of Facilities and Facility Locations Reporting CLABSI—Georgia, 2014

	N	%
No. Hospitals Reporting CLABSI in AP ICU	**95**	
No. Facilities with ≥ 1 Infection	54	57
No. with Significantly More Infections than Predicted	0	0
No. with Significantly Fewer Infections than Predicted	17	18
No. Hospitals Reporting CLABSI in NICU	**31***	
No. Neonatal ICU Locations Reporting	33*	
No. NICU Locations with ≥ 1 Infection	19	58
No. with Significantly More Infections than Predicted	0	0
No. with Significantly Fewer Infections than Predicted	3	9
No. Long-Term Acute Care Hospitals Reporting	**15**	
No. Facilities with ≥ 1 Infection	14	93
No. with Significantly More Infections than Predicted	2	13
No. with Significantly Fewer Infections than Predicted	4	27

**There were 33 individual NICU locations in 31 facilities. Percentages in the NICU section of the table are based on 33 locations.*

Central Line-Associated Bloodstream Infections: SIR by Quarter

Between the first quarter of 2013 and the fourth quarter of 2014, the CLABSI SIR in Georgia hospital AP ICU declined 24% from 0.67 to 0.51. The SIR remained significantly lower than the national baseline value. It was significantly higher than the HHS reduction goal during 2013 and not significantly different during 2014 (Figure 1).

The CLABSI SIR in hospital NICU declined 7% from 0.70 to 0.65. The SIR fluctuated, being significantly lower than the national baseline value as often as it was not significantly different from the national baseline value. The SIR was significantly higher than the HHS reduction goal during the third quarter of 2013, but was otherwise not significantly different (Figure 2).

Between the first and fourth quarters of 2014, the CLABSI SIR in long-term acute care hospitals increased 31% from 0.70 to 0.92. The SIR was not significantly different from the 2013 NHSN baseline value. It was not significantly different from the HHS reduction goal during the first two quarters and significantly higher than the HHS reduction goal during the last two quarters (Figure 3).

Figure 1: Quarterly CLABSI SIR in Hospital AP ICU—Georgia, 2013-2014

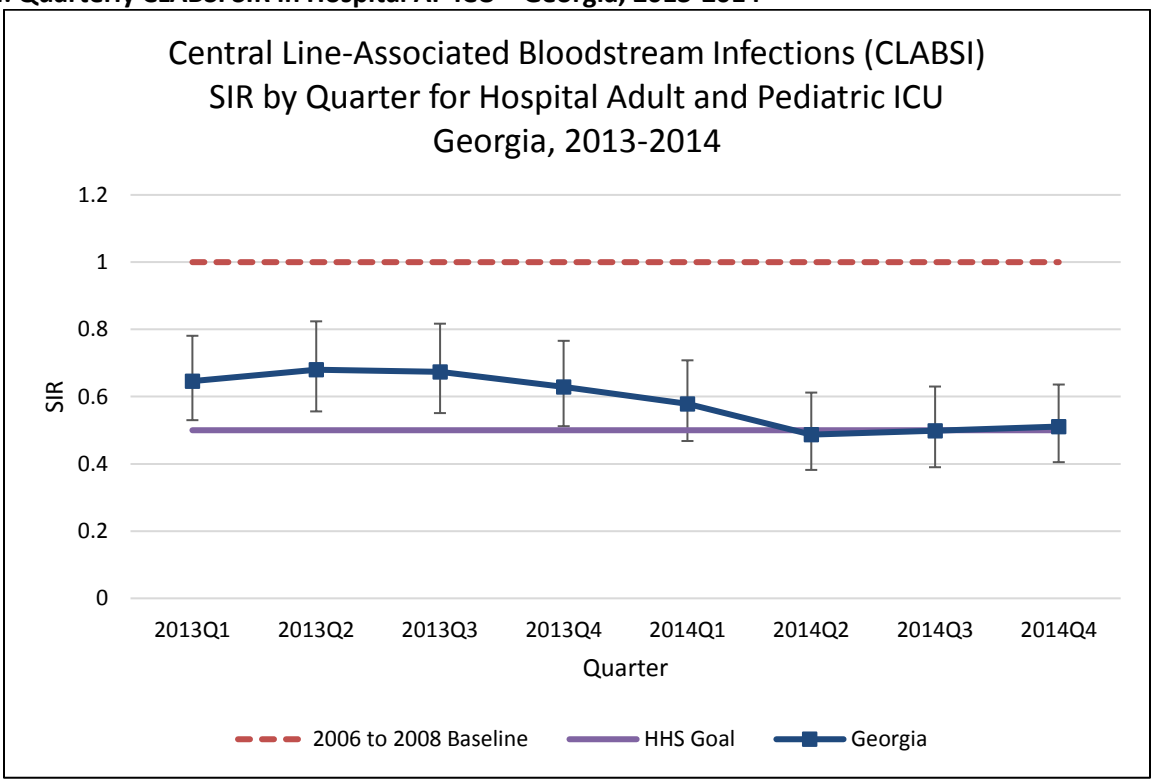


Figure 2: Quarterly CLABSI SIR in Hospital NICU—Georgia, 2013-2014

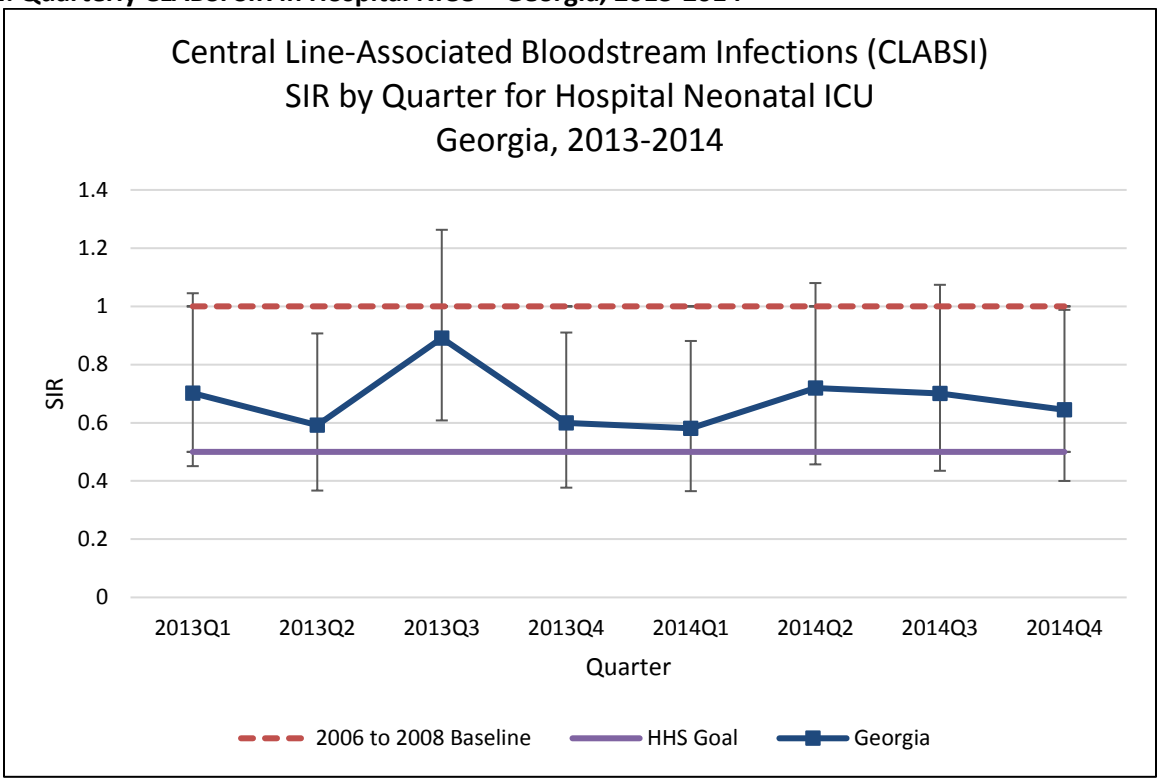
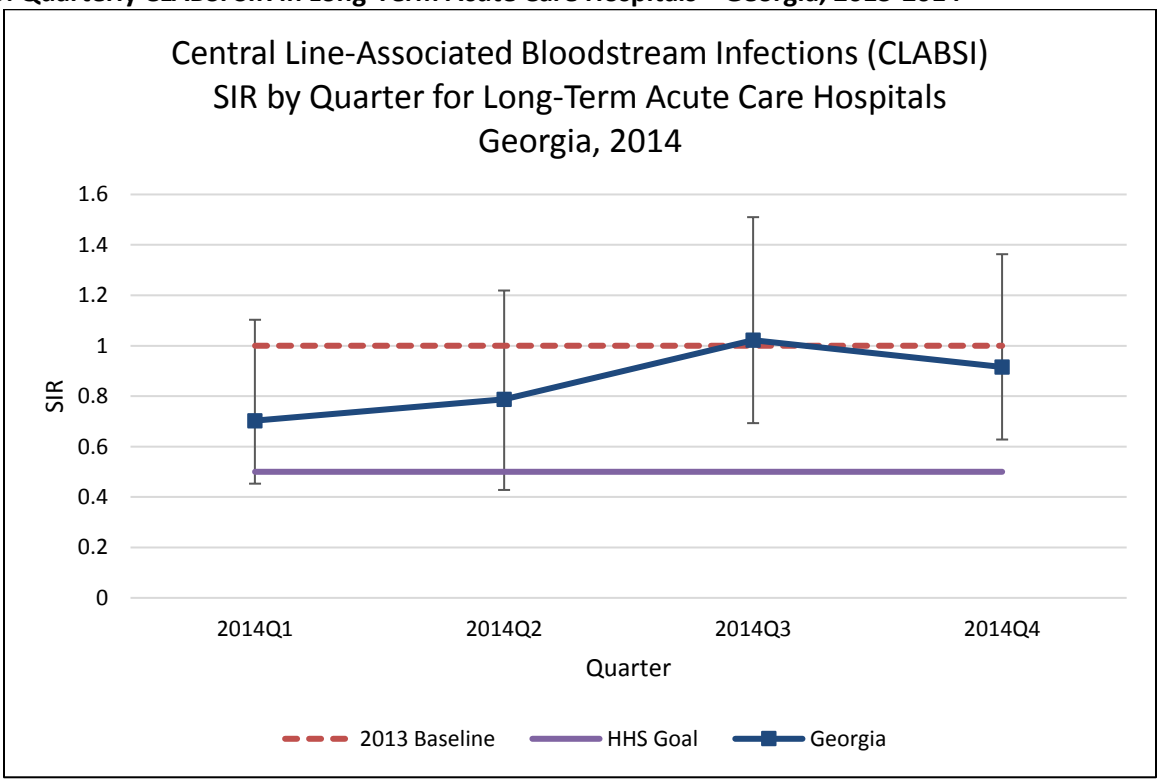


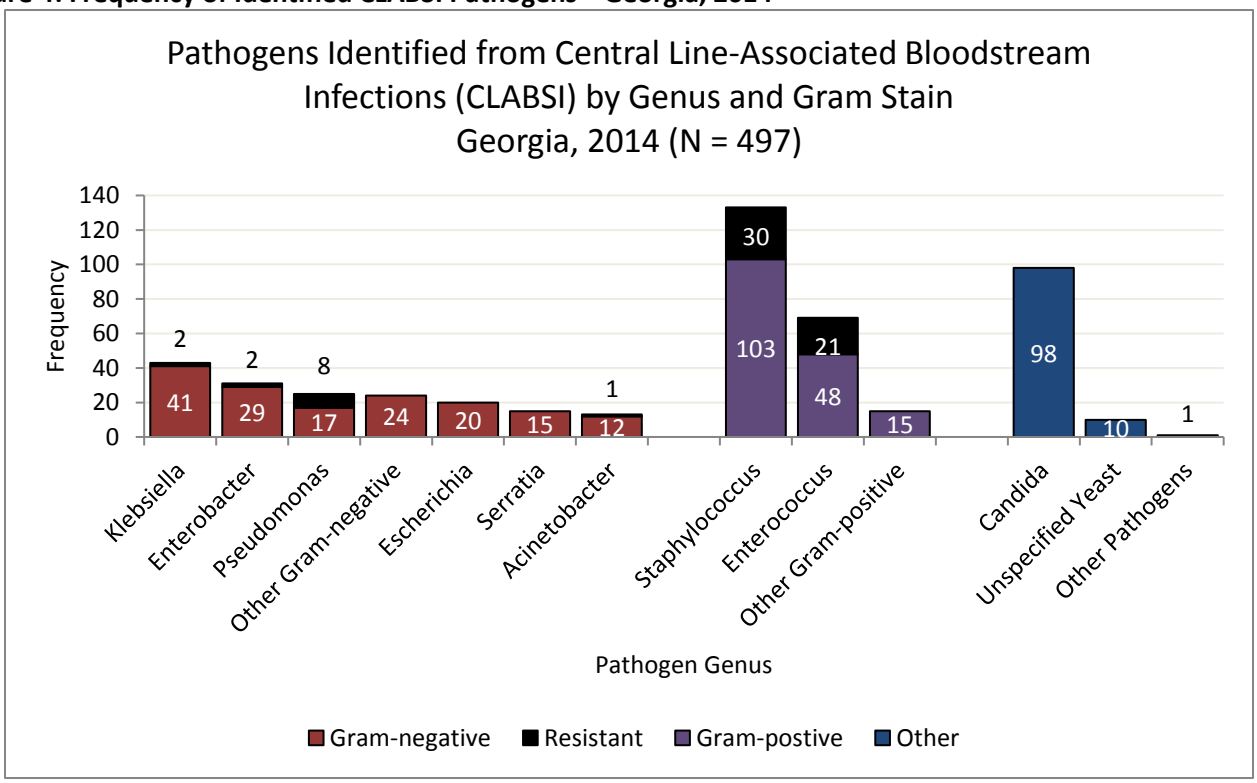
Figure 3: Quarterly CLABSI SIR in Long-Term Acute Care Hospitals—Georgia, 2013-2014



Central Line-Associated Bloodstream Infections: Pathogens Identified

Cultures were performed for 460 CLABSI and resulted in the identification of 497 pathogens. Of the 497 pathogens, 217 (43%) were Gram-positive bacteria, 171 (34%) were Gram-negative bacteria, and 109 (22%) were non-bacterial pathogens. Of the 388 bacterial pathogens, 64 (17%) were antimicrobial-resistant (Figure 4).

Figure 4: Frequency of Identified CLABSI Pathogens—Georgia, 2014



Nearly half of the resistant bacteria identified (30, 47%) were methicillin-resistant. Vancomycin-resistant bacteria accounted for 21 (33%) phenotypes. The remaining 13 (20%) phenotypes were multidrug-resistant, carbapenem-resistant, or carbapenem-non-susceptible (Table 8).

Table 8: Frequency of Resistant Bacterial Phenotypes Identified from CLABSI—Georgia, 2014 (N=64)

Resistance Phenotype	N	%
Methicillin-Resistance in *Staphylococcus aureus*	30	47
Vancomycin-Resistance in *Enterococcus faecalis/faecium*	21	33
Multidrug-Resistance in *Pseudomonas aeruginosa*, *Acinetobacter* spp.	6	9
Carbapenem-Resistance in *Enterobacter* spp., *Klebsiella pneumoniae/oxytoca*	4	6
Carbapenem-non-Susceptibility in *Pseudomonas aeruginosa*	3	5

Catheter-Associated Urinary Tract Infections

In 2014, a total of 1,123 CAUTI were reported from 95 hospitals and 15 long-term acute care hospitals. Of these 1,123 infections, 900 occurred in hospitals and 223 occurred long-term acute care hospitals.

Of the 95 hospitals, 62 (65%) reported at least one CAUTI. Sixteen (17%) hospitals reported having significantly more infections and 7 (8%) reported having significantly fewer infections than predicted. Of the 15 long-term acute care hospitals, 13 (87%) reported at least one CAUTI. Four (27%) long-term acute care hospitals reported having significantly more infections and 4 (27%) reported having significantly fewer infections than predicted (Table 9).

Table 9: Selected Characteristics of Facilities Reporting CAUTI—Georgia, 2014

	N	%
No. of Hospitals Reporting	**95**	
No. Facilities with ≥ 1 Infection	62	67
No. with Significantly More Infections than Predicted	16	17
No. with Significantly Fewer Infections than Predicted	7	8
No. of Long-Term Acute Care Hospitals Reporting	**15**	
No. Facilities with ≥ 1 Infection	13	87
No. with Significantly More Infections than Predicted	4	27
No. with Significantly Fewer Infections than Predicted	4	27

Catheter-Associated Urinary Tract Infections: SIR by Quarter

Between the first quarter of 2013 and the fourth quarter of 2014, the CAUTI SIR in hospitals declined 9% from 1.27 to 1.15. The SIR remained significantly higher than the national baseline value and the HHS reduction goal (Figure 5).

Between the first and fourth quarters of 2014, the CAUTI SIR in Georgia long-term acute care hospitals increased 26% from 0.96 to 1.21. The SIR was not significantly different from the 2013 NHSN value in the first and fourth quarters and was significantly higher during the second and third quarters. The SIR was not significantly different from the HHS reduction goal during the first quarter and was significantly higher during the last three quarters (Figure 6).

Figure 5: Quarterly CAUTI SIR in Hospitals—Georgia, 2013-2014

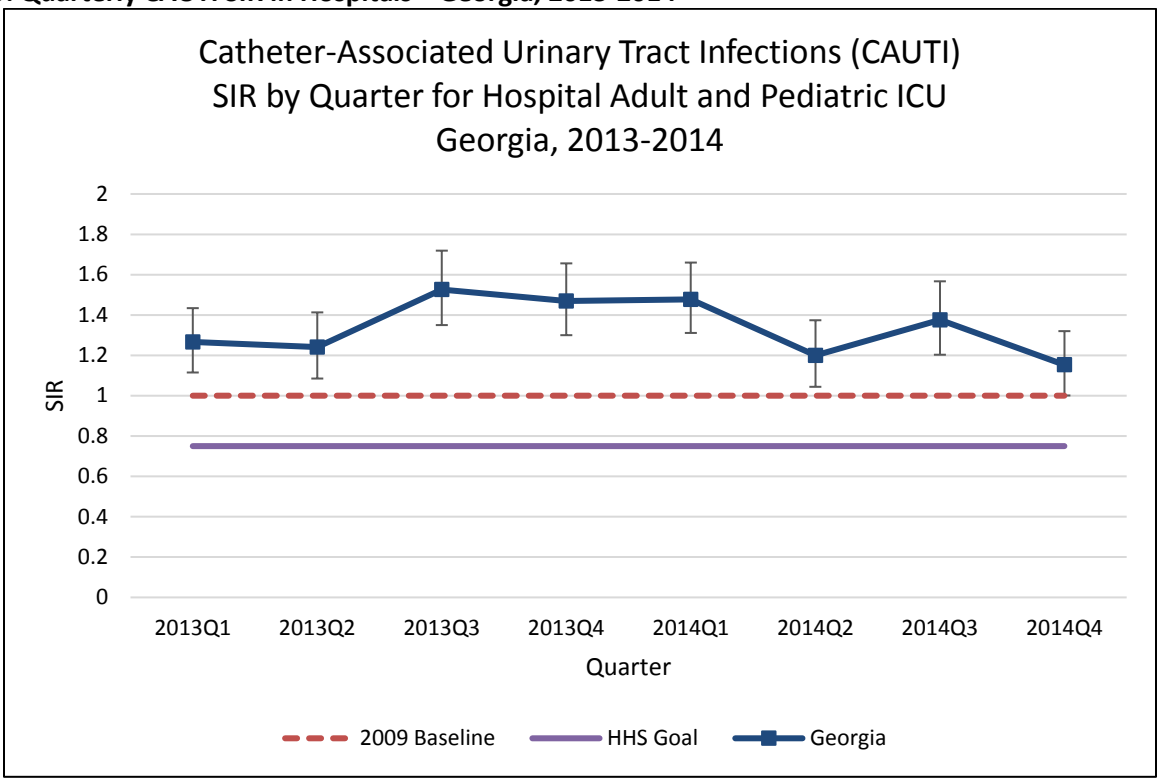
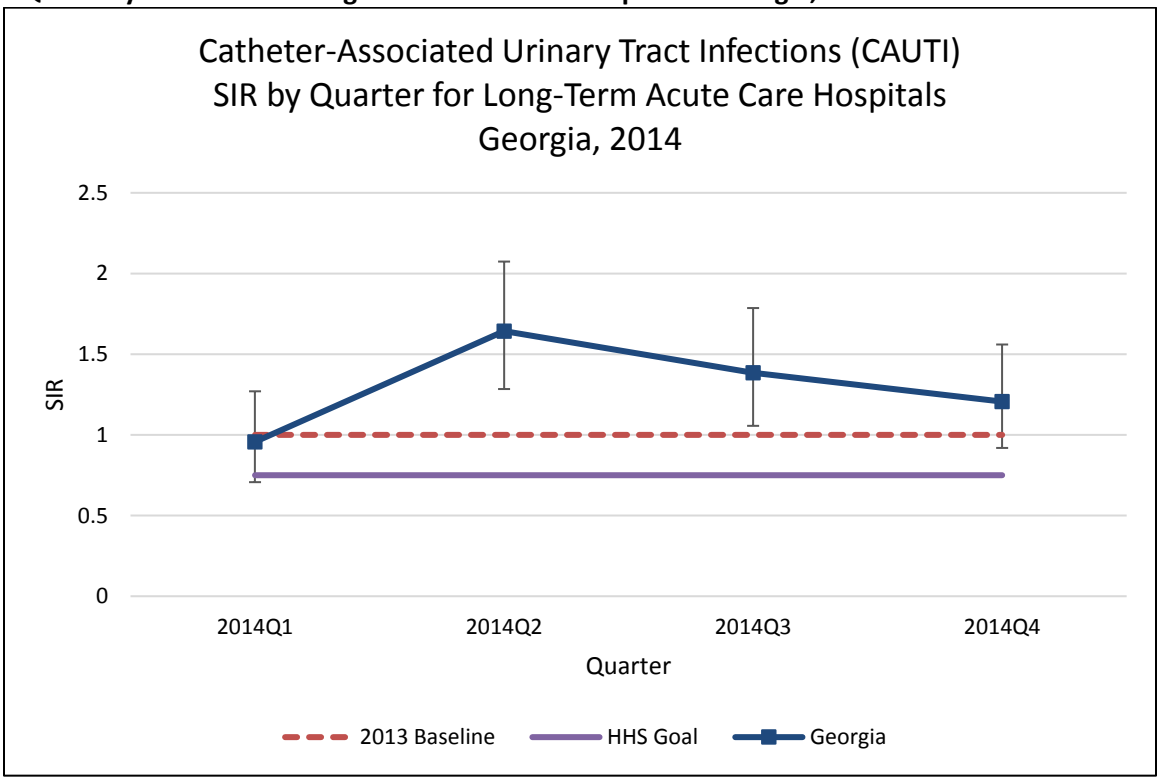


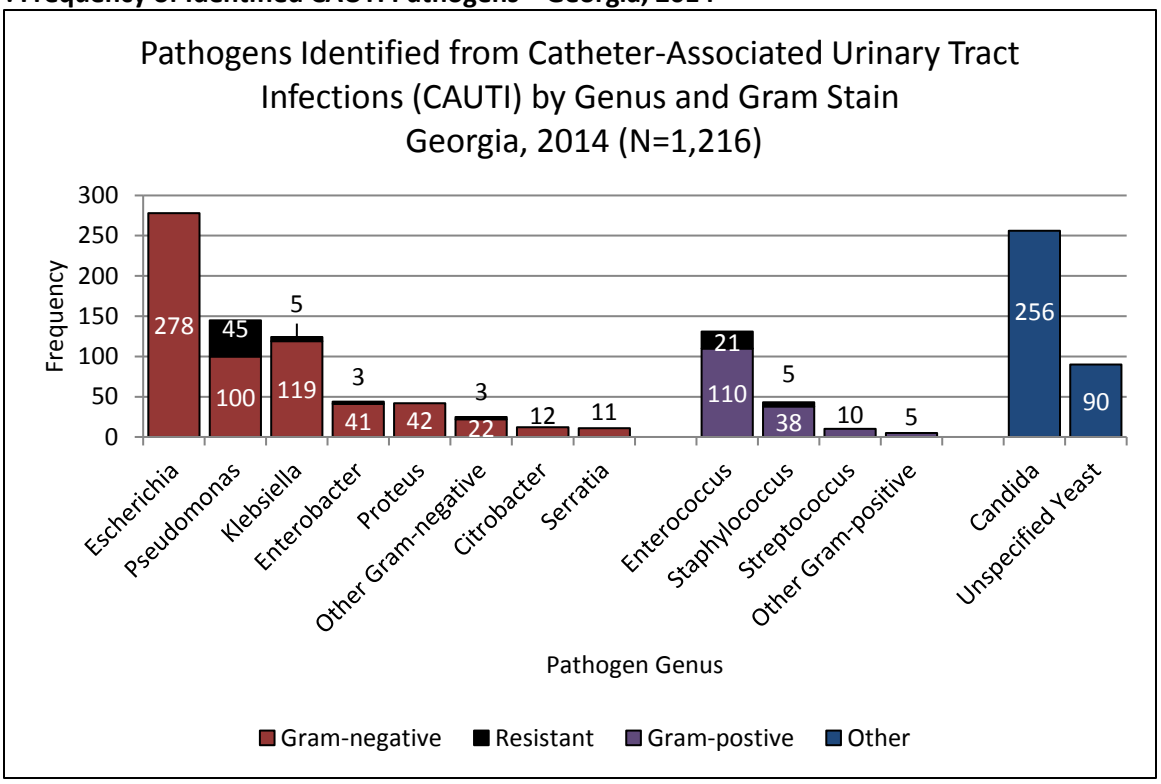
Figure 6: Quarterly CAUTI SIR in Long-Term Acute Care Hospitals—Georgia, 2014



Catheter-Associated Urinary Tract Infections: Pathogens Identified

Cultures were performed for 1,121 CAUTI and resulted in the identification of 1,216 pathogens. Of the 1,216 pathogens, 681 (56%) were Gram-negative bacteria, 346 (28%) were non-bacterial pathogens, and 189 (16%) were Gram-positive bacteria. Of the 870 bacterial pathogens, 82 (9%) were antimicrobial-resistant (Figure 7).

Figure 7: Frequency of Identified CAUTI Pathogens—Georgia, 2014



About half of the resistant bacteria identified (43, 52%) were multidrug-resistant. Vancomycin-resistant bacteria accounted for 21 (26%) phenotypes. The remaining 18 (22%) phenotypes were methicillin-resistant, carbapenem-resistant, or carbapenem-non-susceptible (Table 10).

Table 10: Frequency of Resistant Bacterial Phenotypes Identified from CAUTI—Georgia, 2014 (N=82)

Resistance Phenotype	N	%
Multidrug-Resistance in *Pseudomonas aeruginosa*, *Acinetobacter* spp.	43	52
Vancomycin-Resistance in *Enterococcus faecalis/faecium*	21	26
Carbapenem-Resistance in *Enterobacter* spp., *Klebsiella pneumoniae/oxytoca*	8	10
Methicillin-Resistance in *Staphylococcus aureus*	5	6
Carbapenem-non-Susceptibility in *Pseudomonas aeruginosa*	5	6

Surgical Site Infections following Colon Surgery

In 2014, a total of 234 COLO SSI were reported from 96 Georgia hospitals. Of these, 54 (56%) hospitals reported at least one COLO SSI. Two (2%) hospitals reported having significantly more infections and 5 (5%) reported having significantly fewer infections than predicted (Table 11).

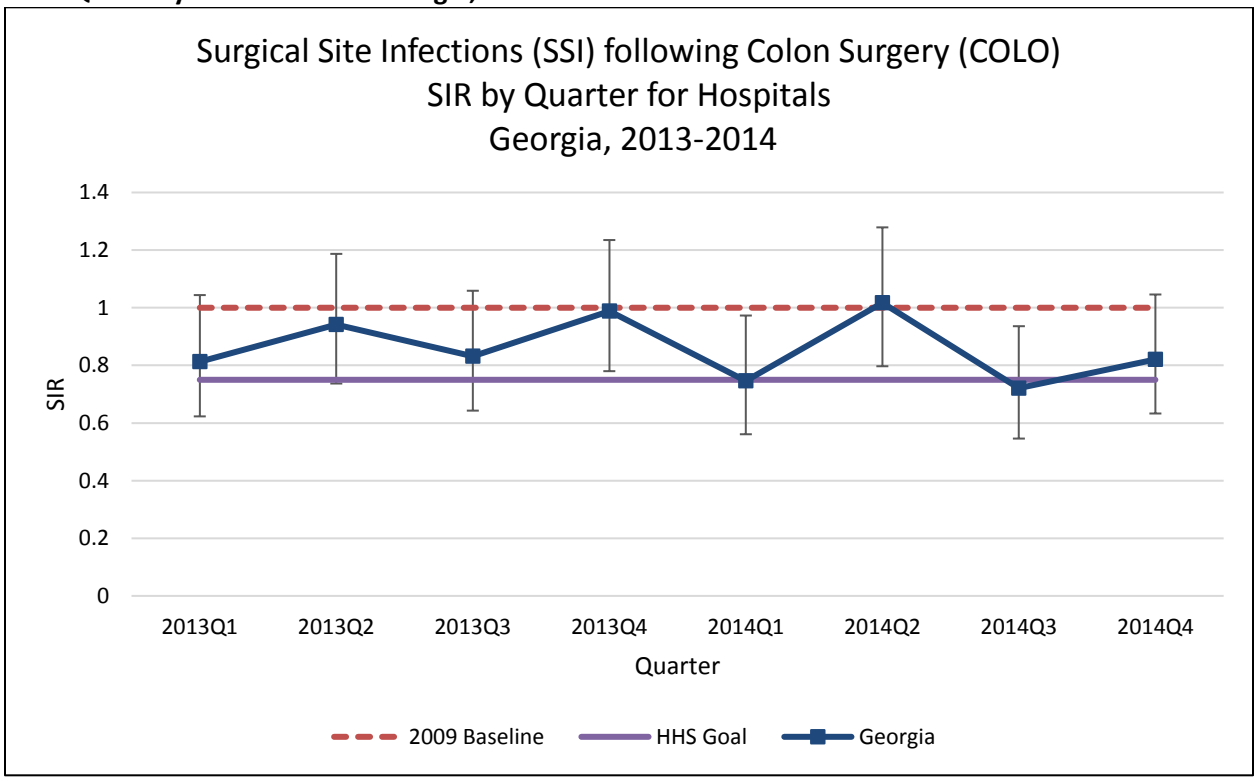
Table 11: Selected Characteristics of Hospitals Reporting COLO SSI—Georgia, 2014 (N=96)

No. Hospitals Reporting	N	%
No. with ≥1 Infection	54	56
No. with Significantly More Infections	2	2
No. with Significantly Fewer Infections	5	5

Surgical Site Infections following Colon Surgery: SIR by Quarter

Between the first quarter of 2013 and the fourth quarter of 2014, the COLO SSI SIR was nearly the same (0.81 vs. 0.82). For the majority of the quarters the SIR was not significantly different from the national baseline value or the HHS reduction goal (Figure 8).

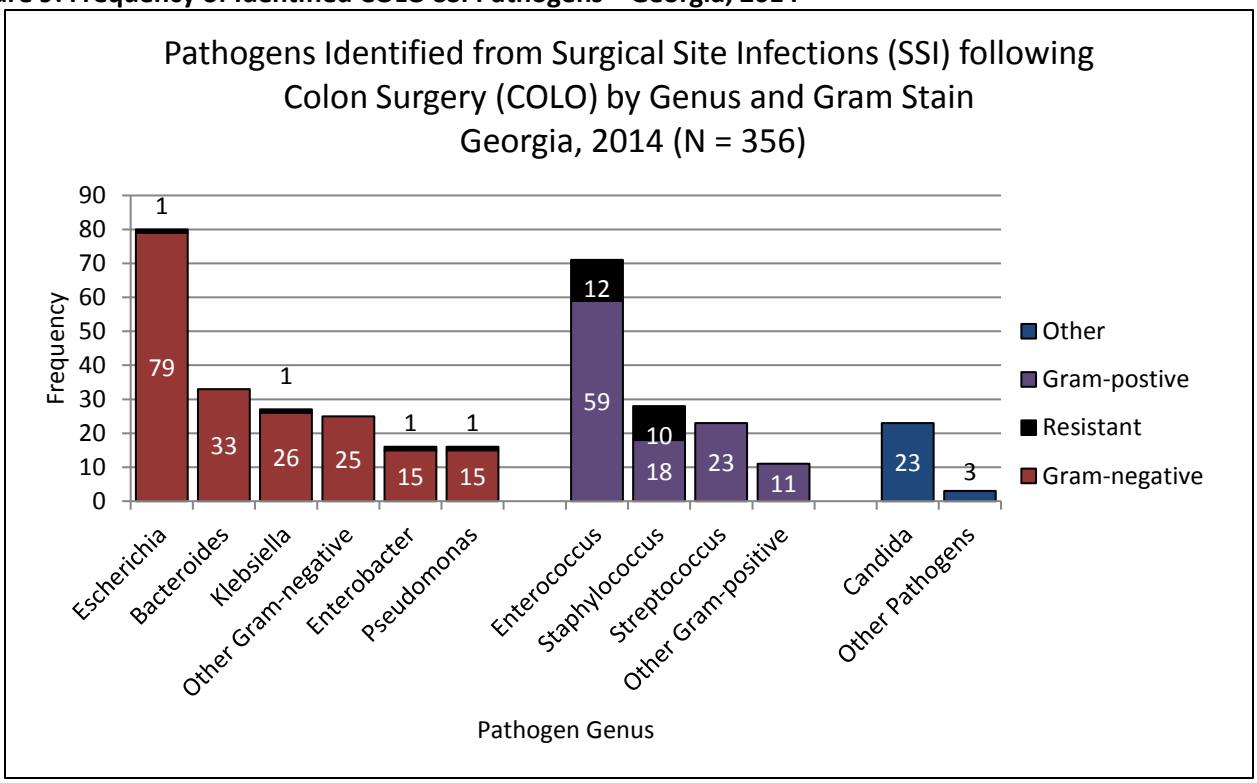
Figure 8: Quarterly COLO SSI SIR—Georgia, 2013-2014



Surgical Site Infections following Colon Surgery: Pathogens Identified

Cultures were performed for 209 COLO SSI and resulted in the identification of 356 pathogens. Of the 356 pathogens, 197 (55%) were Gram-negative bacteria, 133 (37%) were Gram-positive bacteria, 26 (7%) were non-bacterial pathogens. Of the 330 bacterial pathogens, 26 (8%) were antimicrobial-resistant (Figure 9).

Figure 9: Frequency of Identified COLO SSI Pathogens—Georgia, 2014



Nearly half of the resistant bacteria identified (12, 46%) were vancomycin-resistant. Methicillin-resistant bacteria accounted for 10 (38%) phenotypes. The remaining 4 (16%) phenotypes were multidrug-resistant or carbapenem-resistant (Table 12).

Table 12: Frequency of Resistant Bacterial Phenotypes Identified from COLO SSI—Georgia, 2014 (N=26)

Resistance Phenotype	N	%
Vancomycin-Resistance in *Enterococcus faecalis/faecium*	12	46
Methicillin-Resistance in *Staphylococcus aureus*	10	38
Carbapenem-Resistance in *Enterobacter spp., Escherichia coli, Klebsiella pneumoniae/oxytoca*	3	12
Multidrug-Resistance in *Pseudomonas aeruginosa*	1	4

Surgical Site Infections following Abdominal Hysterectomy

In 2014, a total of 99 HYST SSI were reported from 96 hospitals. Of these, 36 (38%) hospitals reported at least one HYST SSI. Two (2%) hospitals reported having significantly more infections and 1 (1%) reported having significantly fewer infections than predicted (Table 13).

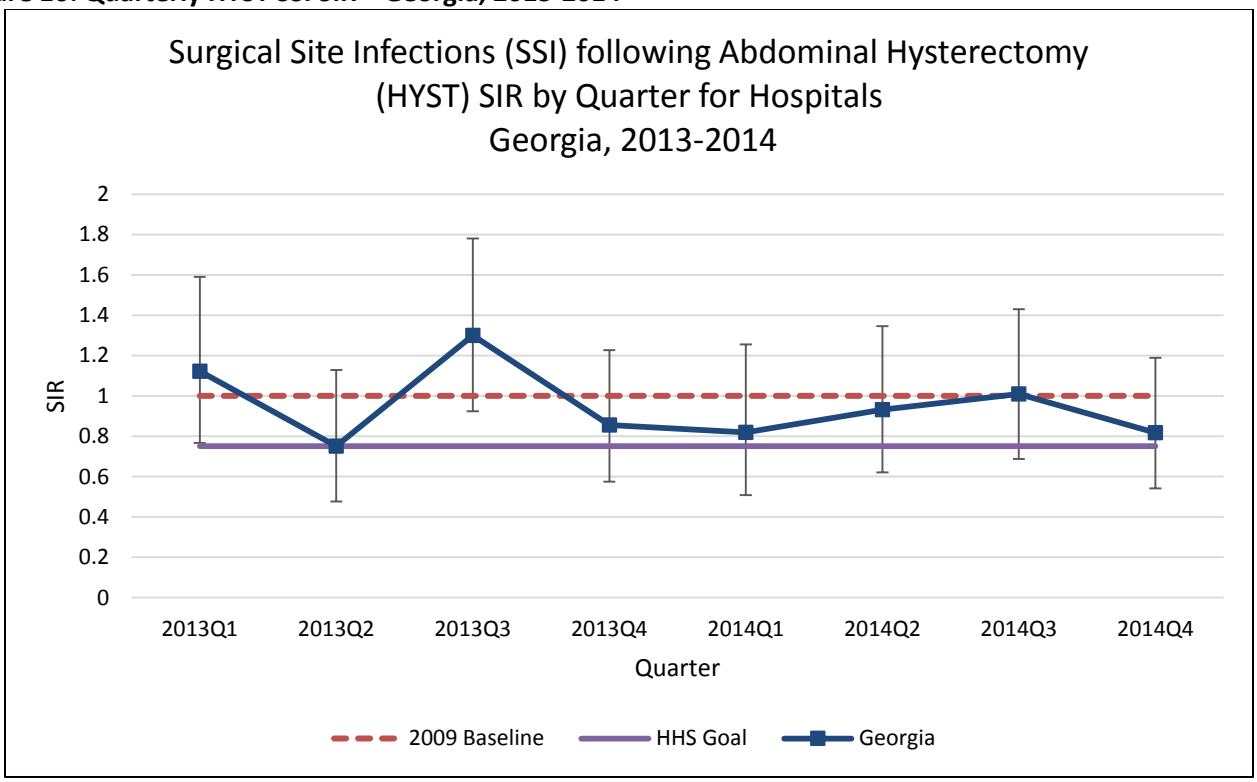
Table 13: Selected Characteristics of Hospitals Reporting HYST SSI—Georgia, 2014 (N=96)

No. Hospitals Reporting	N	%
No. with ≥ 1 Infection	36	38
No. with Significantly More Infections	2	2
No. with Significantly Fewer Infections	1	1

Surgical Site Infection following Abdominal Hysterectomy: SIR by Quarter

Between the first quarter of 2013 and the fourth quarter of 2014, the HYST SSI SIR decreased 27% from 1.12 to 0.82. For the majority of quarters the SIR was not significantly different from the national baseline value or the HHS reduction goal (Figure 10).

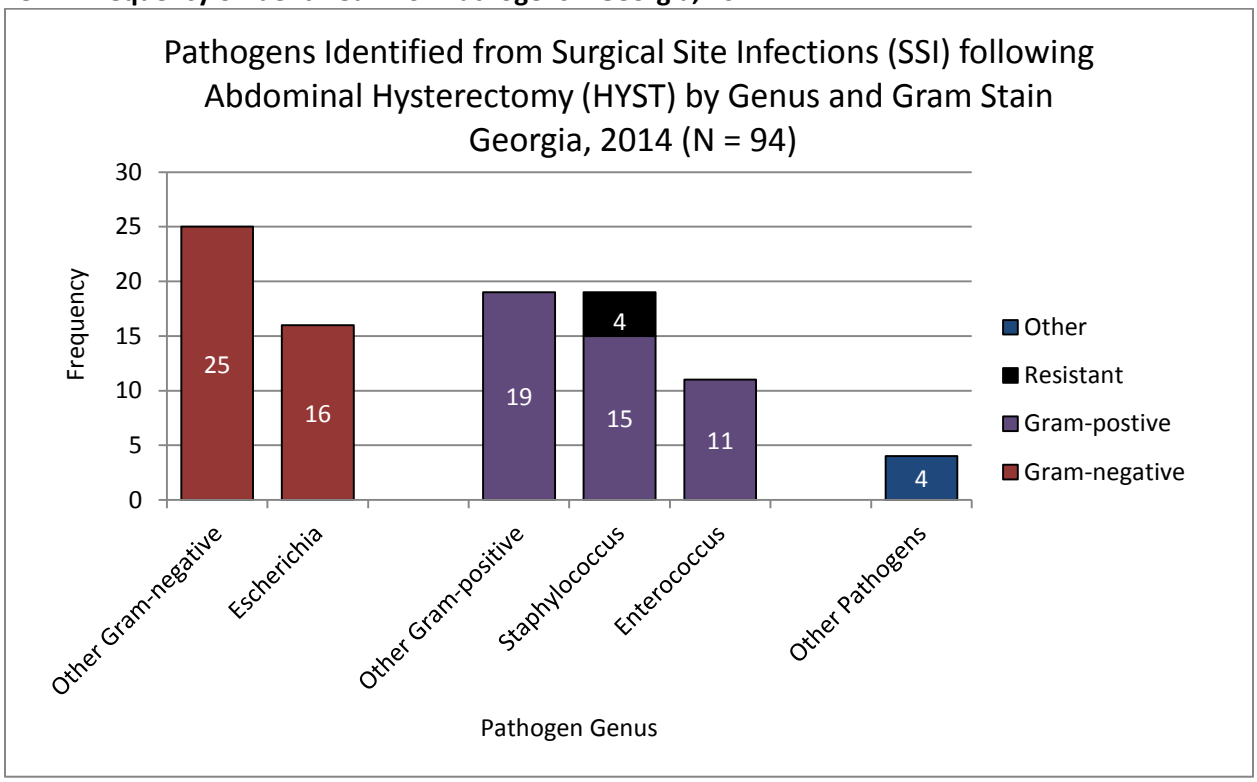
Figure 10: Quarterly HYST SSI SIR—Georgia, 2013-2014



Surgical Site Infections following Abdominal Hysterectomy: Pathogens Identified

Cultures were performed for 68 HYST SSI and resulted in the identification of 94 pathogens. Of the 94 pathogens, 49 (45%) were Gram-positive bacteria, 41 (44%) were Gram-negative bacteria, and 4 (4%) were non-bacterial pathogens. Of the 90 bacterial pathogens, 4 (4%) were antimicrobial-resistant. All 4 were methicillin-resistant *Staphylococcus aureus* (Figure 11).

Figure 11: Frequency of Identified HYST Pathogens—Georgia, 2014



Laboratory-Identified Methicillin-Resistant *Staphylococcus aureus*

In 2014, a total of 324 MRSA infections were reported from 106 hospitals. Of these, 49 (46%) hospitals reported at least one LabID MRSA infection. Six (6%) hospitals reported having significantly more infections and 3 (3%) reported having significantly fewer infections than predicted (Table 14).

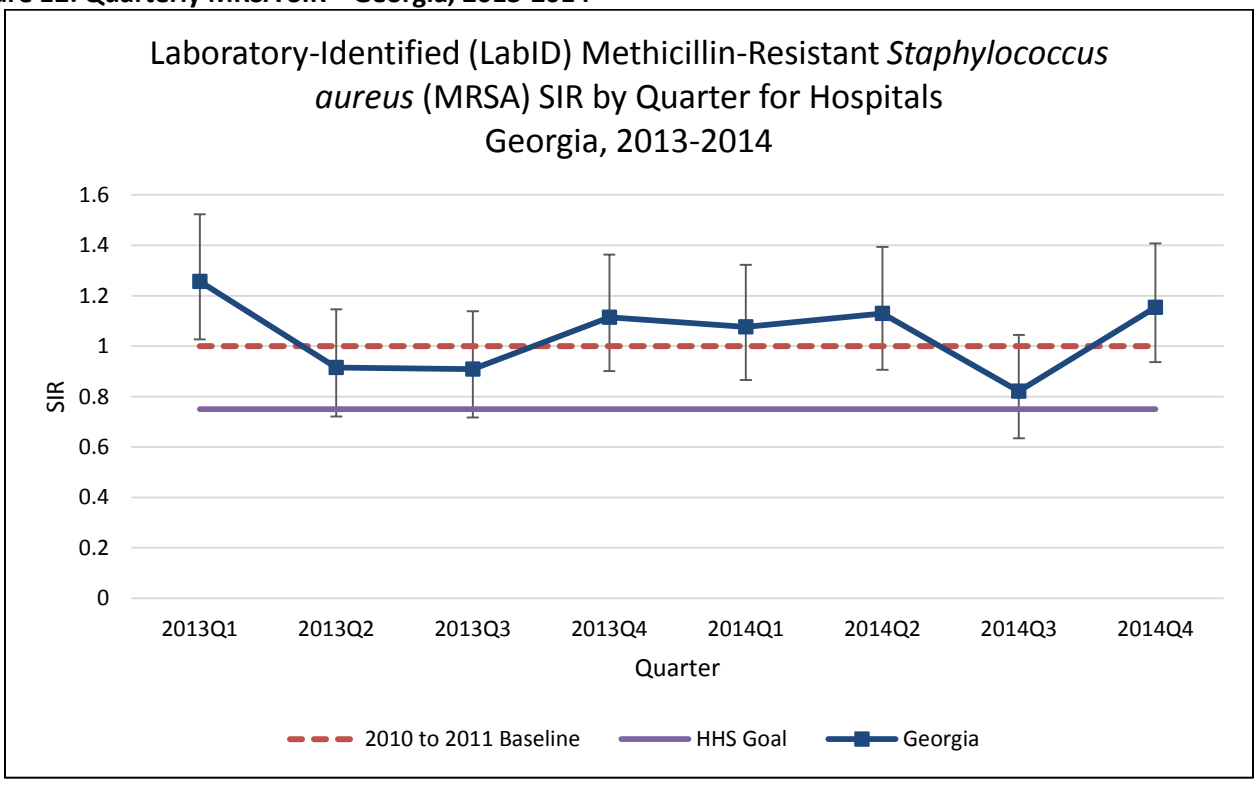
Table 14: Selected Characteristics of Facilities Reporting LabID MRSA Infections —Georgia, 2014 (N=106)

No. Hospitals Reporting	N	%
No. with ≥ 1 Infection	49	46
No. with Significantly More Infections	6	6
No. with Significantly Fewer Infections	3	3

Laboratory-Identified Methicillin-Resistant *Staphylococcus aureus*: SIR by Quarter

Between the first quarter of 2013 and the fourth quarter of 2014, the MRSA SIR decreased 9% from 1.26 to 1.15. The SIR was significantly higher than the NHSN baseline value in the first quarter of 2013 but was otherwise not significantly different. The SIR was significantly higher than the HHS reduction goal except for the second and third quarters of 2013 and the third quarter of 2014, where it was not significantly different (Figure 12).

Figure 12: Quarterly MRSA SIR—Georgia, 2013-2014



Laboratory-Identified *Clostridium difficile*

In 2014, a total of 2,770 *C. difficile* infections were reported from 107 hospitals. Of these, 87 (81%) hospitals reported at least one LabID *C. difficile* infection. Seven (7%) hospitals reported having significantly more infections and 21 (20%) reported having significantly fewer infections than predicted (Table 15).

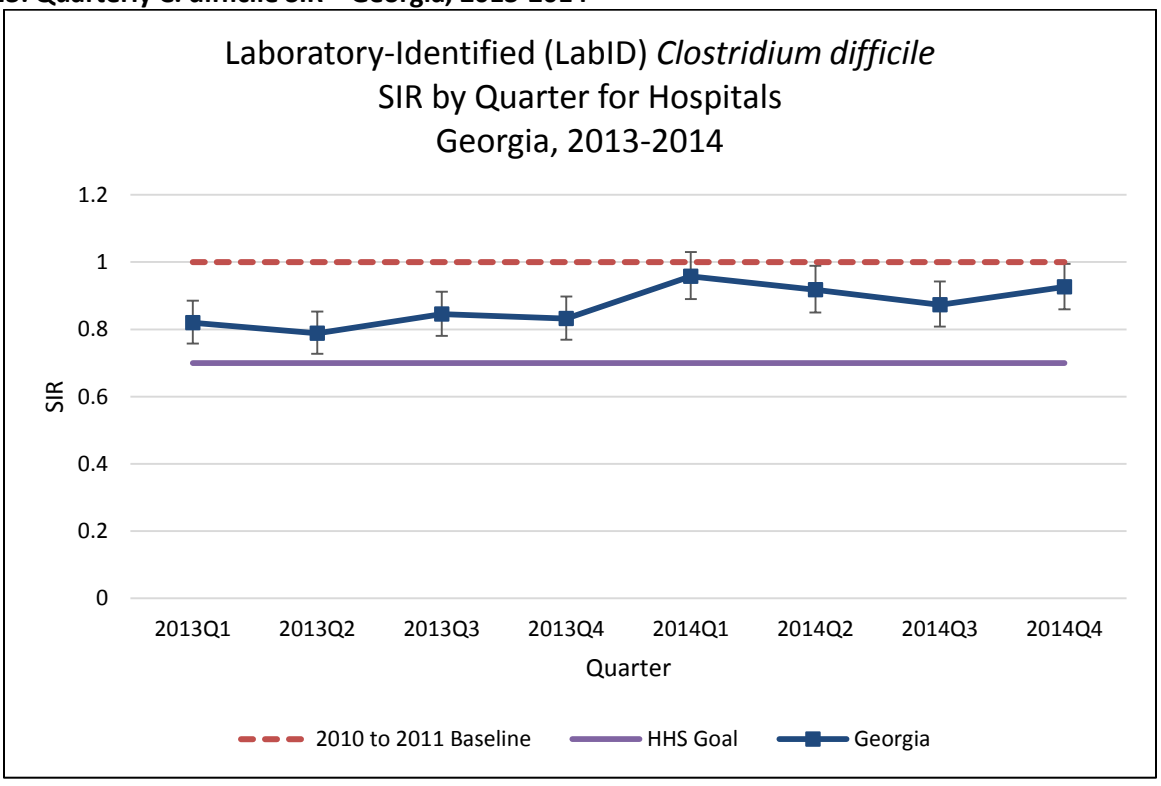
Table 15: Selected Characteristics of Facilities Reporting LabID *C. difficile* Infections—Georgia, 2014 (N=107)

No. Hospitals Reporting	N	%
No. with ≥ 1 Infection	87	81
No. with Significantly More Infections	7	7
No. with Significantly Fewer Infections	21	20

Laboratory-Identified *Clostridium difficile*: SIR by Quarter

Between the first quarter of 2013 and the fourth quarter of 2014, the *C. difficile* SIR increased 13% from 0.82 to 0.93. The SIR was significantly lower than the national baseline value, except for the first quarter of 2014 where it was not significantly different. For all the quarters, the *C. difficile* SIR remained significantly higher than the HHS reduction goal (Figure 13).

Figure 13: Quarterly C. difficile SIR—Georgia, 2013-2014



Discussion

This report establishes Georgia baseline HAI data for long-term acute care hospitals and examines trends in HAI data between 2013 and 2014 in Georgia hospitals.

There was a statistically significant 21% decrease in hospital ICU CLABSI between 2013 and 2014 in Georgia, putting the HHS reduction goal well within reach. There was no change in CLABSI in NICU; the SIR in these locations remains higher than the HHS reduction goal. In long-term acute care hospitals, there were about as many CLABSI as predicted. The CLABSI SIR is higher in long-term acute care hospitals than in other types of facilities and may represent the need for improved prevention efforts.

For all facility types, the number of observed CAUTI was significantly higher than predicted. To reach the predicted number of CAUTI, long-term acute care hospitals would need to prevent 49 infections per year and hospitals would need to prevent 210 infections per year. To reach the HHS reduction goal, long-term acute care hospitals would need to prevent 93 infections per year, and hospitals would need to prevent 383 infections per year. The high number of CAUTI in Georgia is a cause for concern and should be made the focus of improved prevention efforts in Georgia.

Also of concern is the statistically significant 12% increase in the *C. difficile* SIR between 2013 and 2014. While this may be the result of improved testing and surveillance, increases can also indicate wider *C. difficile* spread and changes in antibiotic usage in hospitalized patients. *C. difficile* should also be made the focus of improved prevention efforts.

For COLO, HYST, and MRSA, there was no significant change in SIR between 2013 and 2014. Few (>6%) hospitals saw significantly more HAI than predicted. These hospitals may need targeted interventions to lower their number of HAI.

Future Directions

Antimicrobial-resistance is a serious public health concern, causing infections that are difficult and costly to treat. In 2014, the highest proportion of antibiotic-resistant bacteria was found in CLABSI with 16% of identified bacteria being resistant. Nine percent of CAUTI bacteria, 8% of COLO bacteria, and 4% of HYST bacteria were resistant. Further analysis of the role of hospital stewardship programs, monitoring of pathogen susceptibility patterns, and exploration of trends over time is planned.

In January 2015, CMS reporting requirements were changed to require CLABSI and CAUTI reporting from hospital medical, surgical, and medical/surgical wards and MRSA and *C. difficile* reporting from long-term acute care hospitals. Changes in HAI definitions were also implemented in 2015, including the removal of yeast from the definition of CAUTI. Examination of how these changes will affect Georgia's SIR is planned.

Limitations

There may be variation between results published by the DPH and results published elsewhere (e.g., CMS Hospital Compare). Hospitals have the ability to update their data in NHSN at any time once entered, and as such, results may appear to vary if other sources use different data collection periods or report cutoff dates than Georgia's reports.

This report presents data from only a subset of possible HAI that can occur in hospitals. Likewise, the report does not present all susceptibility data collected from cultured pathogens. Conclusions cannot be drawn about HAI or pathogen susceptibility outside what is presented in this report.

Acknowledgements

The HAI Program would like to thank the Infection Prevention, Quality, and Information Technology Staff at Georgia hospitals for collaborating to provide the data presented in this report.

Appendix I: Acronyms

AP	Adult and Pediatric
C. difficile	*Clostridium difficile*
CAUTI	Catheter-Associated Urinary Tract Infection
CDC	Centers for Disease Control and Prevention
CLABSI	Central Line-Associated Bloodstream Infection
CMS	Centers for Medicaid and Medicare Services
COLO	Colon Surgery
DPH	Georgia Department of Public Health
HAI	Healthcare-Associated Infection
HHS	Health and Human Services
HYST	Abdominal Hysterectomy
ICU	Intensive Care Unit
LabID	Laboratory-Identified
MDR	Multidrug-resistant
MRSA	Methicillin-resistant *Staphylococcus aureus*
NHSN	National Healthcare Safety Network
NICU	Neonatal Intensive Care Unit
NNTP	Number of Infections Needed to Prevent
SIR	Standardized Infection Ratio
SSI	Surgical Site Infection
TAP	Targeted Assessment for Prevention

Appendix II: Additional Information on HAI Identification

- Identifying Healthcare-associated Infections (HAI) for NHSN Surveillance: http://www.cdc.gov/nhsn/PDFs/pscManual/2PSC_IdentifyingHAIs_NHSNcurrent.pdf
- Urinary Tract Infection (Catheter-Associated Urinary Tract Infection [CAUTI] and Non-Catheter-Associated Urinary Tract Infection [UTI]) and Other Urinary System Infection [USI]) Events: http://www.cdc.gov/nhsn/PDFs/pscManual/7pscCAUTIcurrent.pdf
- Bloodstream Infection Event (Central Line-Associated Bloodstream Infection and Non-central line-associated Bloodstream Infection): http://www.cdc.gov/nhsn/PDFs/pscManual/4PSC_CLABScurrent.pdf
- Surgical Site Infection (SSI) Event: http://www.cdc.gov/nhsn/PDFs/pscManual/9pscSSIcurrent.pdf?agree=yes&next=Accept
- Multidrug-Resistant Organism & *Clostridium difficile* Infection (MDRO/CDI) Module: http://www.cdc.gov/nhsn/PDFs/pscManual/12pscMDRO_CDADcurrent.pdf

Appendix III: Methods Details

From the CSTE/CDC HAI Data Analysis and Presentation Standardization Workgroup's Healthcare Associated Infection Data Analysis and Presentation Standardization Toolkit except where noted ""*

What do the numbers mean?

It's important to understand that numbers alone won't show how well a hospital is doing in preventing HAI. This report shows how hospitals performed during a single year (2014), and compares each hospital's performance to the national baseline. It does not track the hospital's performance over time.

SIR are calculated using a numerator (number of infections) and a denominator (population at risk). Larger hospitals that see more patients or perform more surgeries may have more infections compared to smaller hospitals. Therefore, it is important not only to consider the SIR interpretation for each hospital, but to also look at the total number of procedures performed and the total number of infections observed (or identified) in that time period.

Where do the numbers come from?

Hospitals self-report their HAI data to the CDC and DPH using the free, web-based software system NHSN. CDC provides training to hospital staff on the appropriate use of this system and provides guidance on how to track infections in a standard way.

Although efforts were made through education and training to improve the standardization and understanding of NHSN surveillance guidelines, definitions, and criteria, there can be variability in interpretation and application, leading to differences in reporting practices among hospitals. Furthermore, hospitals with more resources and/or a robust HAI surveillance program may be able to identify and report more infections compared to a hospital with fewer resources.

In this report, the number of predicted infections is an estimate based on infections reported to NHSN by participating facilities nationwide during the following baseline time periods:

- 2006 to 2008: CLABSI and SSI
- 2009: CAUTI
- 2010 to 2011: MRSA bacteremia and *C. difficile* LabID infections

Once CDC updates the national baselines, Georgia will be able to publish SIR that compare infections to a more recent time period.

These reports cover data that were collected during calendar year 2014 and were downloaded from NHSN on December 16, 2015; any changes made to the data after this data are not reflected in this report.

More information about NHSN can be found here: http://www.cdc.gov/NHSN.

Information on how to generate a facility-level TAP report can be found here:
http://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/tapreports_facilities.pdf

Laboratory-Identified Infection Analyses

Clostridium difficile and methicillin-resistant *Staphylococcus aureus* LabID infections rely on laboratory data. Patients do not have to meet clinical criteria for their infections to be reported to NHSN, which allows for a much less labor-intensive means to track *C. difficile* and MRSA infections. LabID infections that occurred more than 3 calendar days after admission are included in the numerator of the SIR.

DPH would like to highlight certain caveats in using and interpreting LabID infection data. For example, experience in other states has shown that CDI rates tend to be higher when using LabID infection data compared to a clinical case definition. Reasons for this may include differences in how individual facilities define and classify clinical disease, when specimens are obtained, and variations in hospital laboratory testing methods and practices. LabID infections should be considered a 'proxy' measure to estimate the number of CDI and MRSA infections actually occurring.

Despite these caveats, there are benefits to using LabID data. LabID infections do not depend on clinical interpretation by providers and thus offer a more standardized and consistent method of collecting and reporting CDI and MRSA surveillance data. Moreover, LabID infections are currently being used by CMS for quality reporting programs. Improving prevention practices as described in existing clinical guidelines should result in a decrease in the number of observed CDI and MRSA LabID infections as well as a decrease in the number of clinical infections.

Risk Adjustment

The SIR are adjusted for risk factors that may impact the number of infections reported by a hospital, such as type of patient care location, bed size of the hospital, patient age, and other factors. The SIR is adjusted differently depending on the type of infection measured.

The SIR for CLABSI and CAUTI are adjusted for:

- Type of patient care location
- Hospital affiliation with a medical school
- Bed size of the patient care location

The SIR for hospital-onset *C. difficile* and MRSA bloodstream infections are adjusted for:

- Facility bed size
- Hospital affiliation with a medical school
- The number of patients admitted to the hospital who already have *C. difficile* or an MRSA bloodstream infection ("community-onset" cases)
- For hospital-onset *C. difficile*, the SIR also adjusts for the type of test the hospital laboratory uses to identify *C. difficile* from patient specimens

- *The SSI SIR are presented using the CMS risk adjustment model. The SSI reported are deep incisional primary and organ/space infections detected during the operative hospitalization, on readmission to the hospital where the surgery was performed or on admission to another hospital, or through post-discharge surveillance. The CMS model adjusts for:
- Patient age
- Patient assessment at time of anesthesiology

However, while NHSN collects information on many important factors that may put a patient at risk for an HAI, the system is not able to obtain every detail about every person. Each patient and healthcare location has a different set of risks that may not be fully accounted for in the calculation of the SIR.

The data presented have a limited risk-adjustment that may not take into account patient or facility difference that could contribute to the incidence of HAI.

Statistical Significance

The p-value and 95% confidence interval are statistical measures that describe the likelihood that what was observed was due to random chance.

These measures tell us whether or not a facility's SIR is significantly different from 1 (the value we would expect if the facility performed exactly the same as what was predicted based on national data). If the p-value was less than 0.05, we can conclude that the number of observed infections is *significantly different* that the number of predicted infections (i.e., the facility's SIR is significantly different from 1). If the p-value is greater than 0.05, we can conclude that the number of observed infections in a facility is *not significantly different* than the number predicted (i.e., the facility's SIR is no different than 1).

DPH uses the p-value to evaluate the significance of the SIR and provide an interpretation.

Quality Assurance and Data Validation

The data are not validated by DPH. Although efforts were made by hospitals and the DPH to ensure that the data were accurate and complete, a formal validation of the data has not yet been performed.